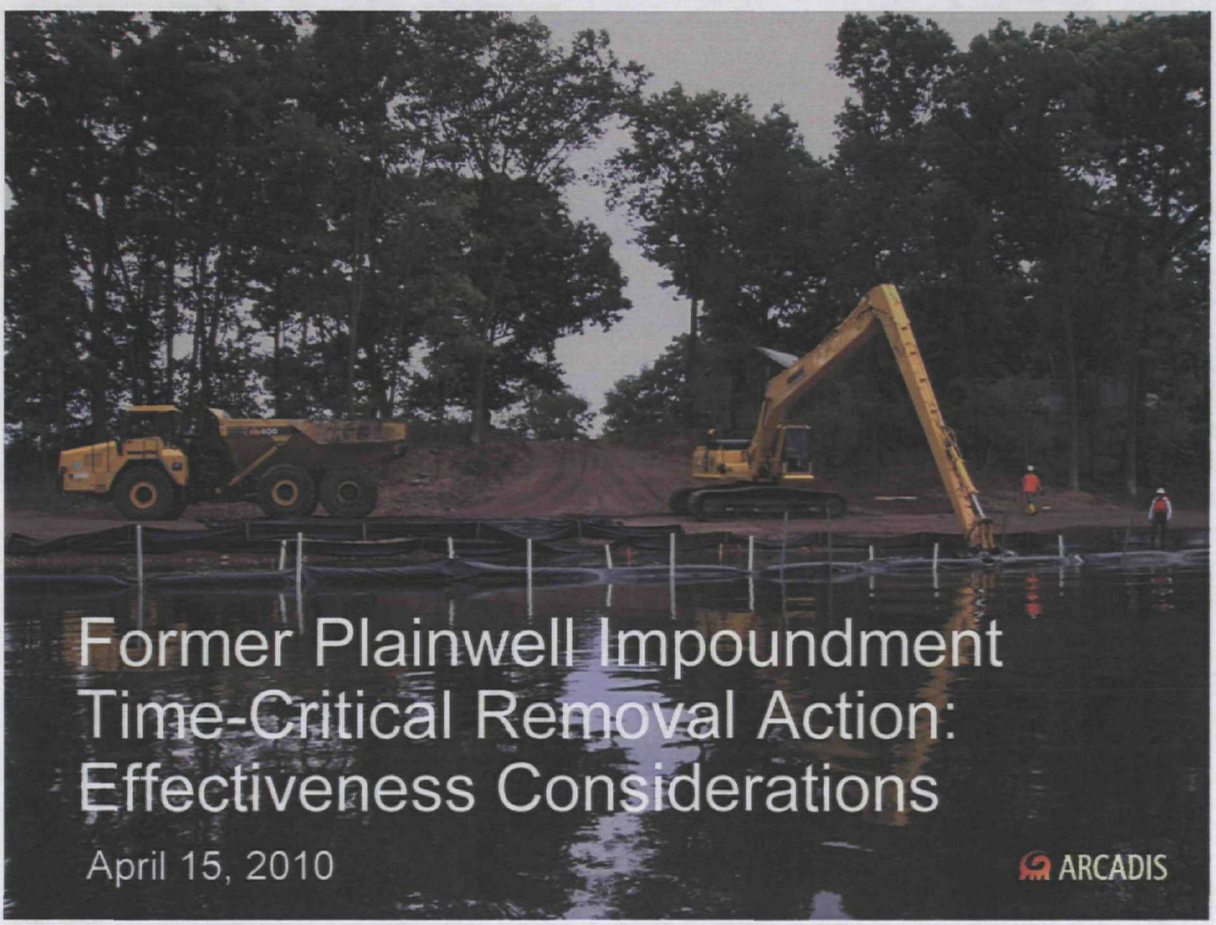

Former Plainwell Impoundment Time-Critical Removal Action: Effectiveness Considerations

April 15, 2010

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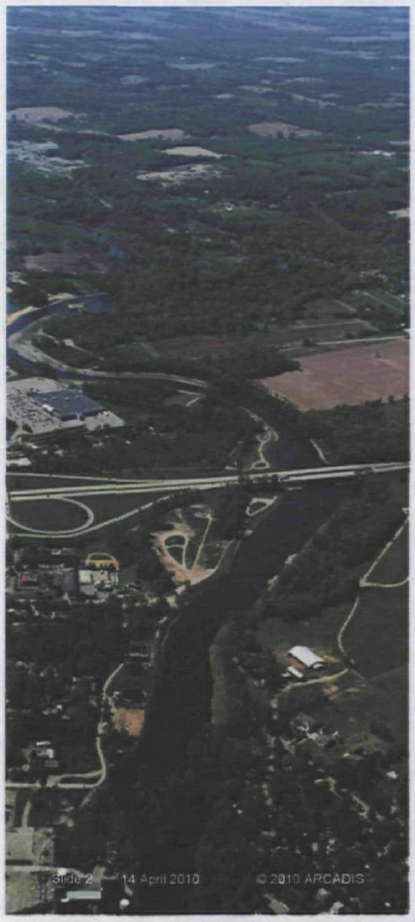

Topics of Discussion

- Project Status
- Conceptual Site Model
- Project Development, Objectives, and Design Overview
- Monitoring Activities
- Effectiveness Considerations

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Project Status

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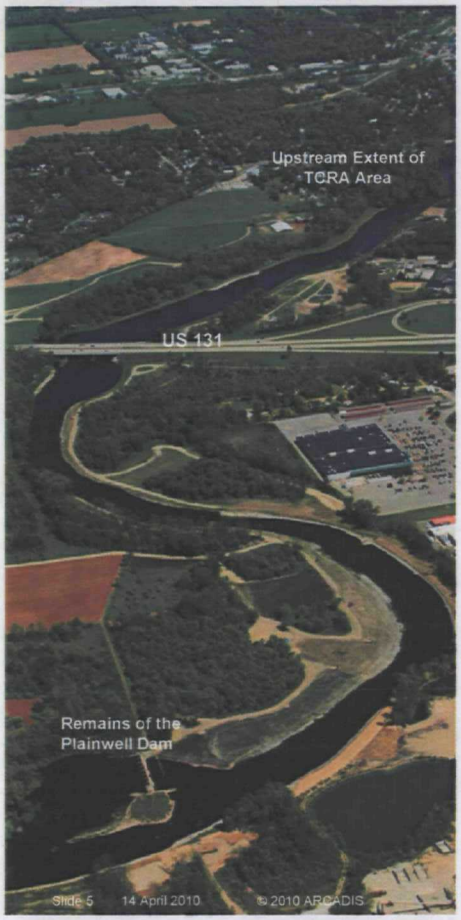
Plainwell Project Status

- Removal and Restoration Construction Activities
  - Site prep began April 2007, first materials excavated June 2007
  - Removal activities completed January 2009
  - Replanting completed June 2009
  - Notice of Completion received March 30, 2010
- Post-Removal Activities
  - Monitoring and bank maintenance (if needed) for three years
  - Residual risk evaluation to be done as part of Area 1 risk assessment



Project Summary

- Stabilized eroding banks and restored river bank habitat along 1.5 miles of the Kalamazoo River – 900+ trees and native shrubs planted
- 130,000 cy of sediments and soils removed across 27 acres
- 5,000 pounds of PCBs removed
- Materials disposed at commercial landfills (16% TSCA, 84% non-TSCA)
- Remains of Plainwell Dam powerhouse removed
- Flow restored in historical western channel – 5 miles of free-flowing conditions
- Monitoring of restored areas to continue for 2 more years

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Conceptual Site Model (CSM)

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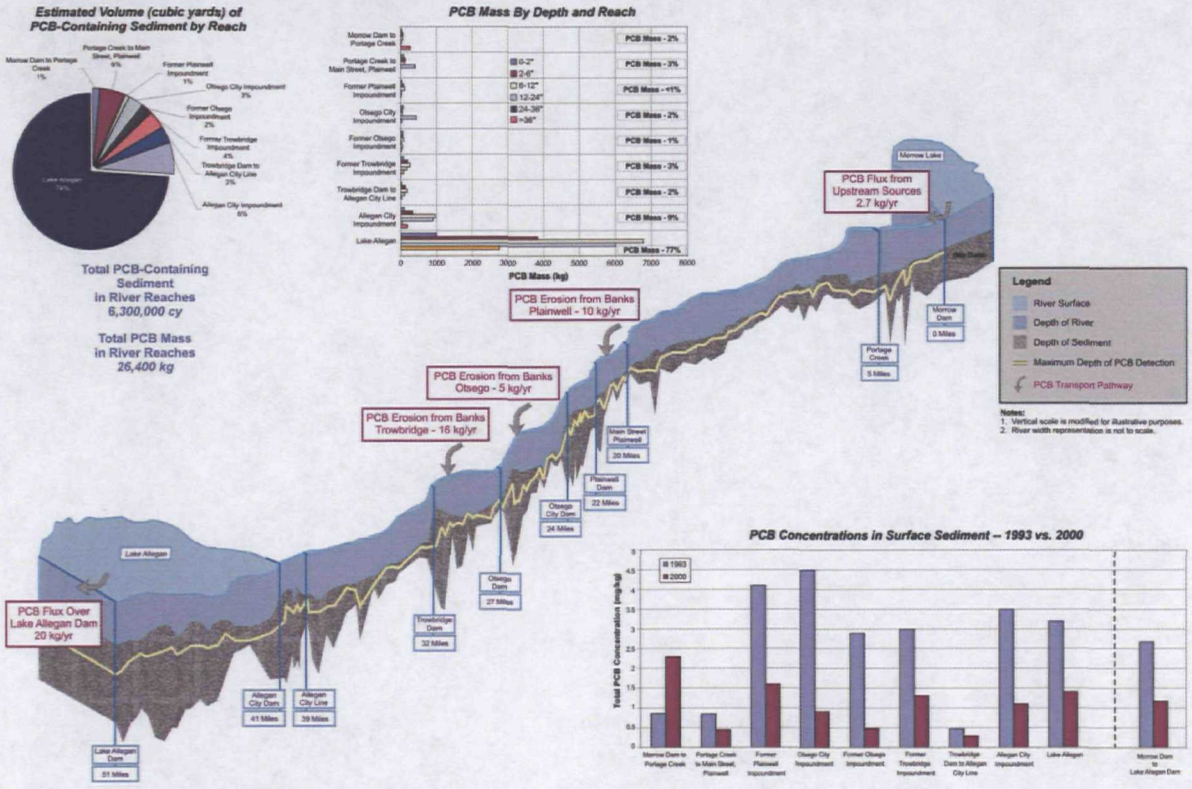
CSM Overview



CSM Key Points

Primary Risk Driver

- PCBs in fish is the key risk driver

PCB Sources

- Bank erosion is single largest continuing external source
- Extensive source control actions conducted and planned in upstream areas
- Continuing watershed sources remain – Morrow Lake, urban areas, industrial sites, regional atmospheric deposition, other
- Upstream sources factor into need for fish consumption advisories and take on greater importance as more significant sources are addressed

Upstream of Plainwell

- River upstream of Plainwell energetic with predominately low levels of PCBs
- Limited PCB mass inventory

Plainwell Impoundment

- Former "Lake Plainwell" captured significant inventory of PCB-containing sediment – first major depositional area downstream of Kalamazoo
- Dam drawdown in 1970/1980s caused channel incisement and eroding banks
- Bank soils falling along toe of bank sustained higher sediment PCB concentrations along those shorelines
- Main channel sediment PCBs are low in comparison, with localized higher levels in deposits near the dam

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Project Development, Objectives, and Design Overview

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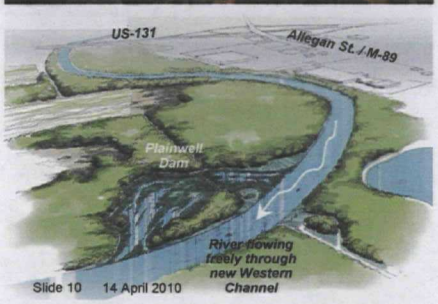

Project Planning Process

- Two-year planning process with key stakeholders – USEPA, MDEQ, Natural Resource Trustees, KRSG
- Integrated Cleanup and River Restoration:
  - Former Plainwell Impoundment recognized as a key Area 1 concern (Morrow Dam to Plainwell Dam)
  - Stemming resupply of PCBs from eroding banks identified as a key issue
  - No CERCLA authority to require dam removal; however, dam removal to control water levels and restore free flowing river was key basis for agreement
  - USEPA February 14, 2007 Action Memo provided for consideration of dam removal in design phase
  - Targeted removal of sediments (near-shore and PCB hot spots) incorporated with bank stabilization to prevent downstream migration with dam removal
  - February 2007 AOC for TCRA Project Construction
  - Second AOC for River SRI/FS included addressing residual risk in Area 1 and long-term monitoring

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Removal Action Objectives

From February 2007 Design Report:

- Cut back and stabilize river banks (source control)
- Dredge/excavate targeted PCB-containing sediments: behind Plainwell Dam, three mid-channel deposits, near-shore areas (source control)
- Dewater/process and dispose excavated materials (source control)
- Excavate targeted PCB-containing floodplain soils (risk management)
- Control resuspension of sediments during construction
- Evaluate effects of lowering water levels on movement of sediments during construction and erosion of restored banks/floodplains
- Establish stable channel, re-vegetate work zones, and conduct post-construction monitoring

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Key Design Elements

- Construct and operate water control structure to manage river levels during construction and allow controlled drawdown of water
- Remove near-shore sediments and cut back banks – designed to control sources of PCBs and achieve a stable, natural channel design
  - Near-shore sediments removed to cutline defining pre-impoundment channel bottom
  - Bank soils removed to 30 ft back from top of bank to create clean buffer and isolate PCBs from new bank face
  - Different bank stabilization approaches (soft vs. hard) used in different areas of the project site; slope no steeper than 3:1
- Remove three mid-channel sediment deposits with PCBs > 50 ppm
  - Remove to 1 ppm or cutline defining pre-impoundment channel bottom
- Remove floodplain soils with PCBs > 50 ppm to cleanup level of 5 ppm
- Remove floodplain soils in targeted north bank areas upstream of US 131 Bridge with PCBs > 4 ppm (near residential areas)

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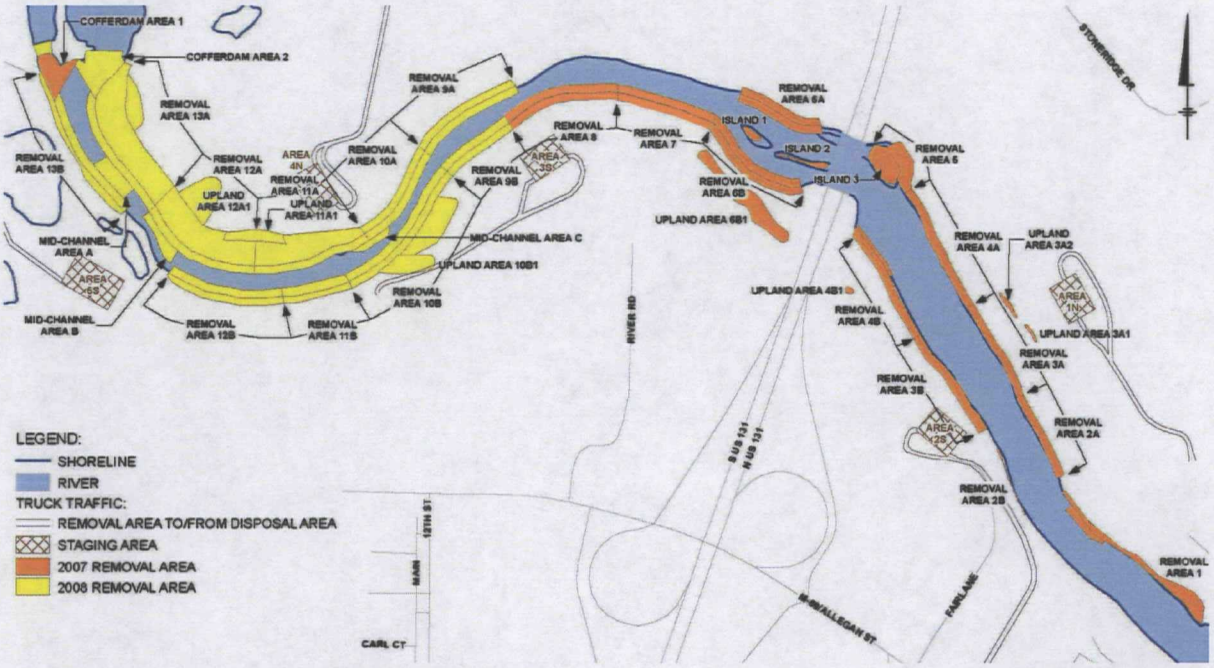
Key Design Elements *(cont'd)*

- Remove the former powerhouse to restore free-flowing conditions in western channel
- Design/select appropriate turbidity/resuspension controls
- Process excavated materials, dispose at off-site landfills
- Restore/revegetate river banks and floodplain areas – use clean soils from removal areas as cover where appropriate
- Conduct monitoring activities before, during, and after construction

TCRA Removal Areas



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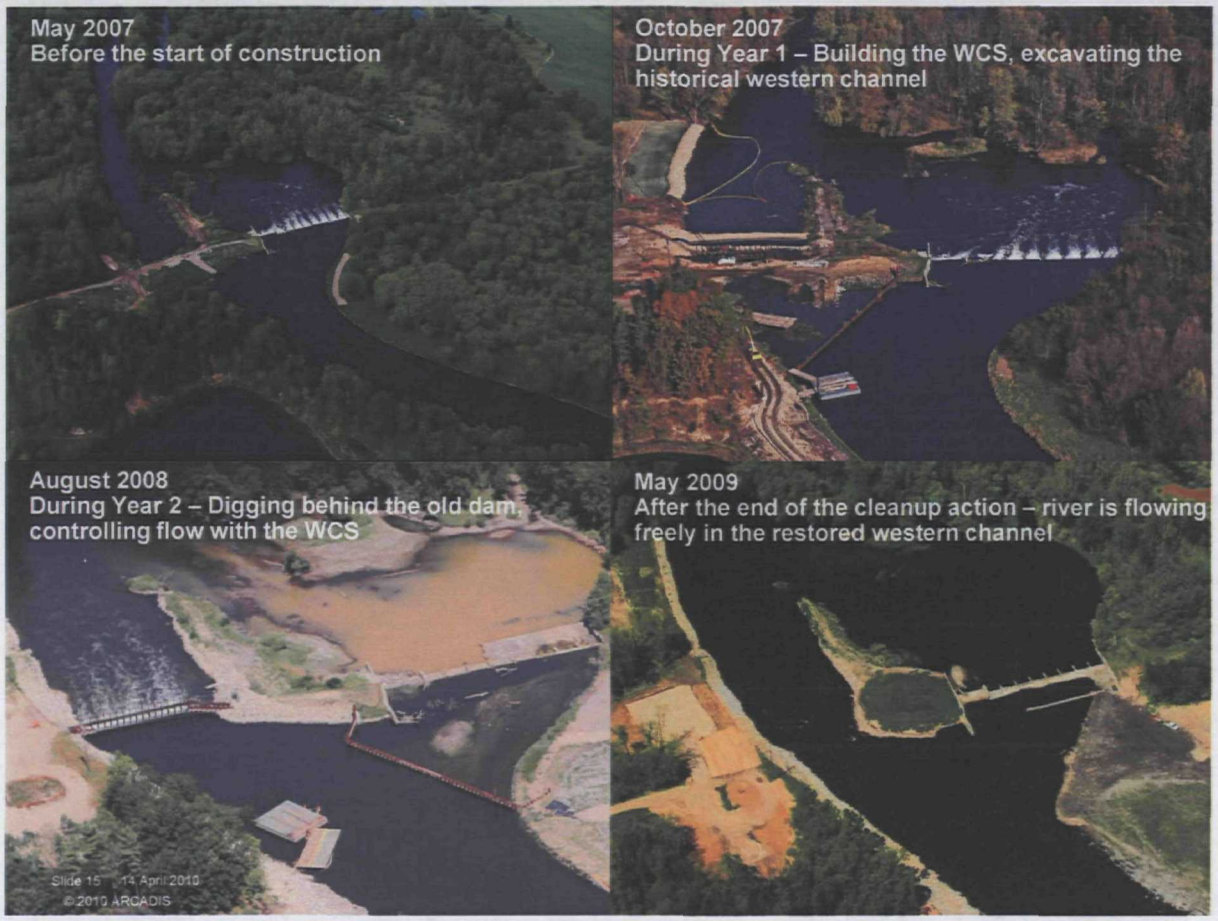
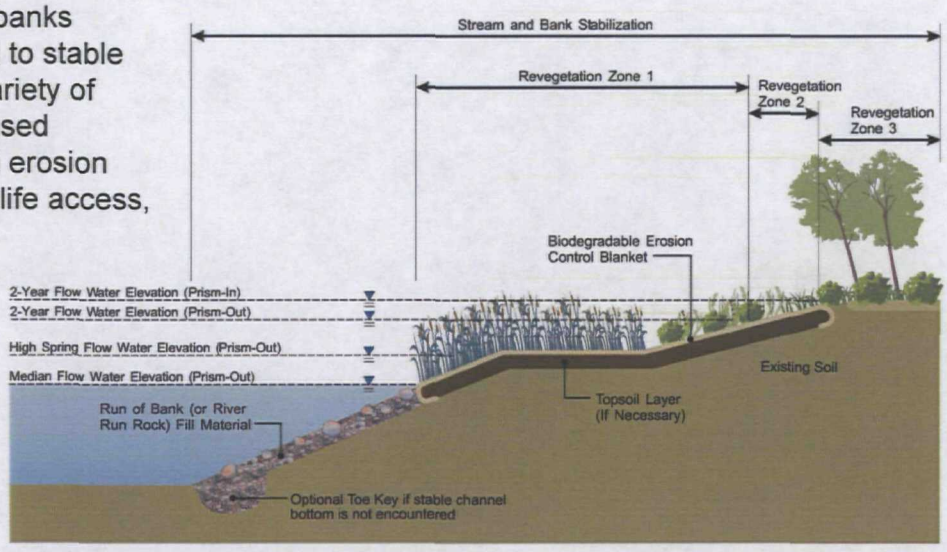


Bank Restoration

- All disturbed banks reconstructed to stable condition – variety of approaches used depending on erosion potential, wildlife access, aesthetics



- 30-foot wide buffer zone established/replanted/restored in floodplain
- Use of hard armor minimized where possible
- Monitoring/maintenance plan based on adaptive management approach

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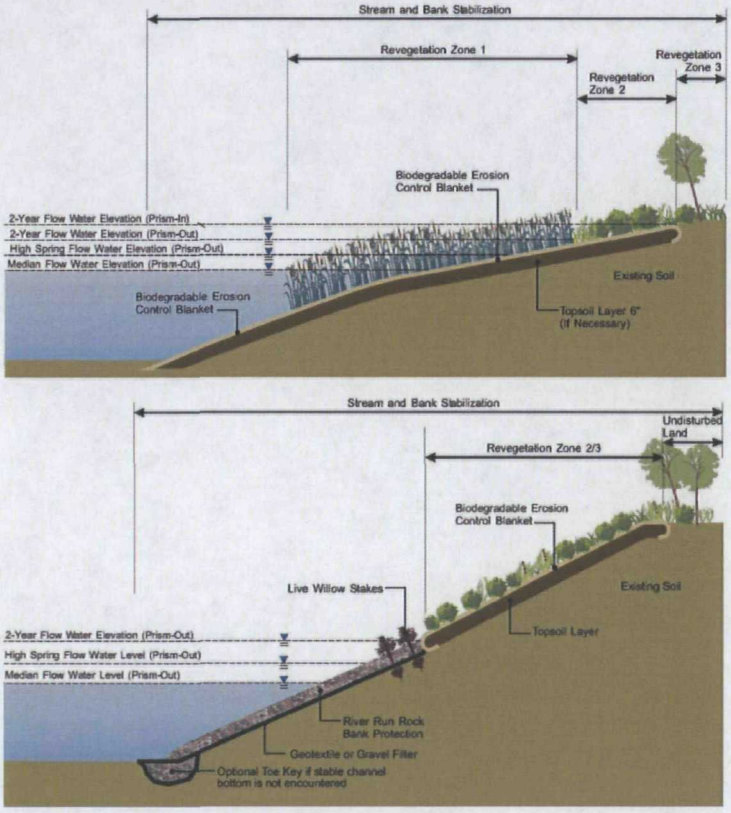
Bank Restoration *(cont'd)*



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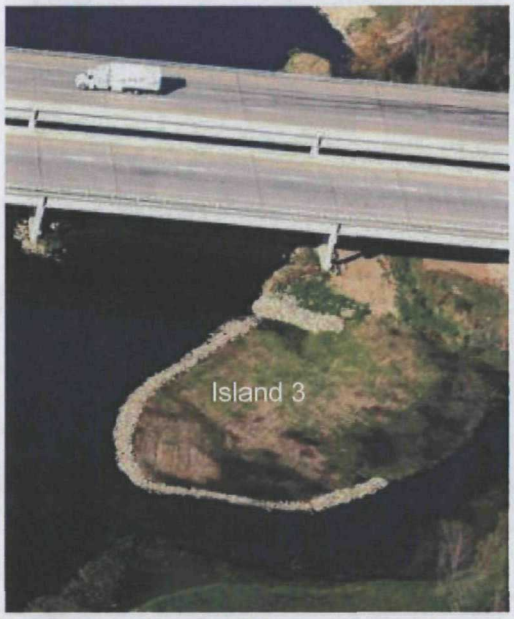
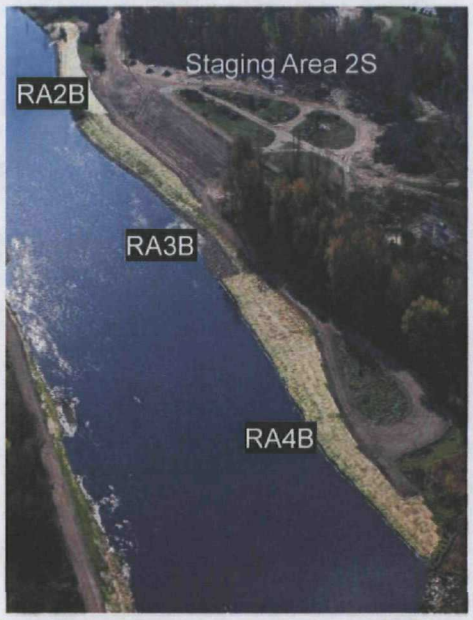
Bank Stabilization Approaches





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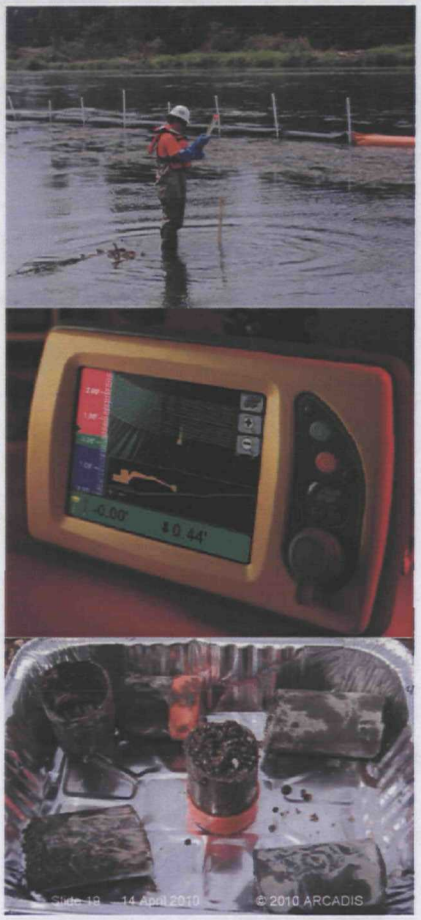

Excavation Confirmation

- Real Time Kinematic Global Positioning System (RTK GPS) used to confirm removal target elevations
  - Data displayed continuously and recorded at pre-set locations to document removal elevation
- In-water excavation determined complete based on survey confirmation that design cutline was achieved
- Completion of excavation in bank and floodplain removal areas was verified through confirmation sampling
- Re-excavation conducted as needed

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Monitoring Activities

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Monitoring to Assess Effects/ Impacts of Construction

Area 1 SRI Work Plan & TCRA Design Report:

- Surface Water Monitoring upstream and downstream of Plainwell Impoundment
- Yearling Fish Monitoring in Otsego City Impoundment
- Post-Removal Sediment Sampling
- Bathymetric Monitoring
- Groundwater Sampling

TCRA Design Report:

- Water Column PCB and Turbidity Monitoring at work areas
- Bank and Habitat Monitoring/Maintenance

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Surface Water Monitoring

Upstream & Downstream of Plainwell

- Objective: Quantify increase in solids and PCB loads in the river downstream of Plainwell, if any, that may be attributable to construction activities
- Samples collected every other day during active construction
  - Upstream – 10th Street Bridge in Plainwell
  - Downstream – Farmer Street Bridge in Otsego
  - October 2007 – December 2007: 37 sample pairs
  - March 2008 – January 2009: 139 sample pairs
- 402 total samples collected – 398 non-detect results
  - Maximum value 0.19 ug/L from upstream
- Data show no discernable contribution to solids or PCB transport resulting from construction activities

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Surface Water Monitoring Locations

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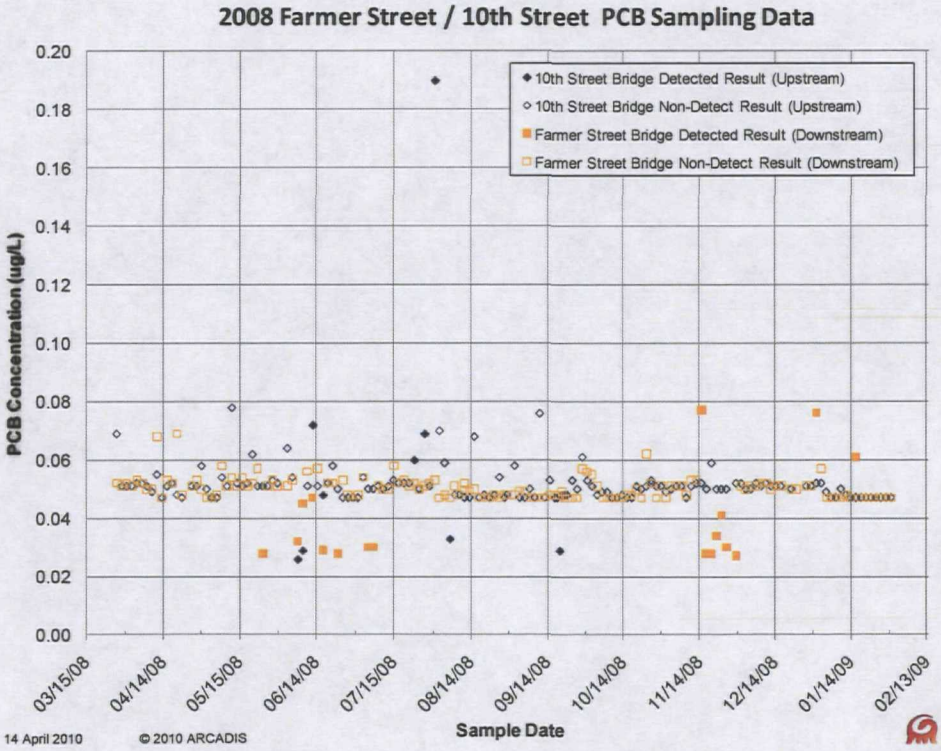
Surface Water Sampling PCB Data



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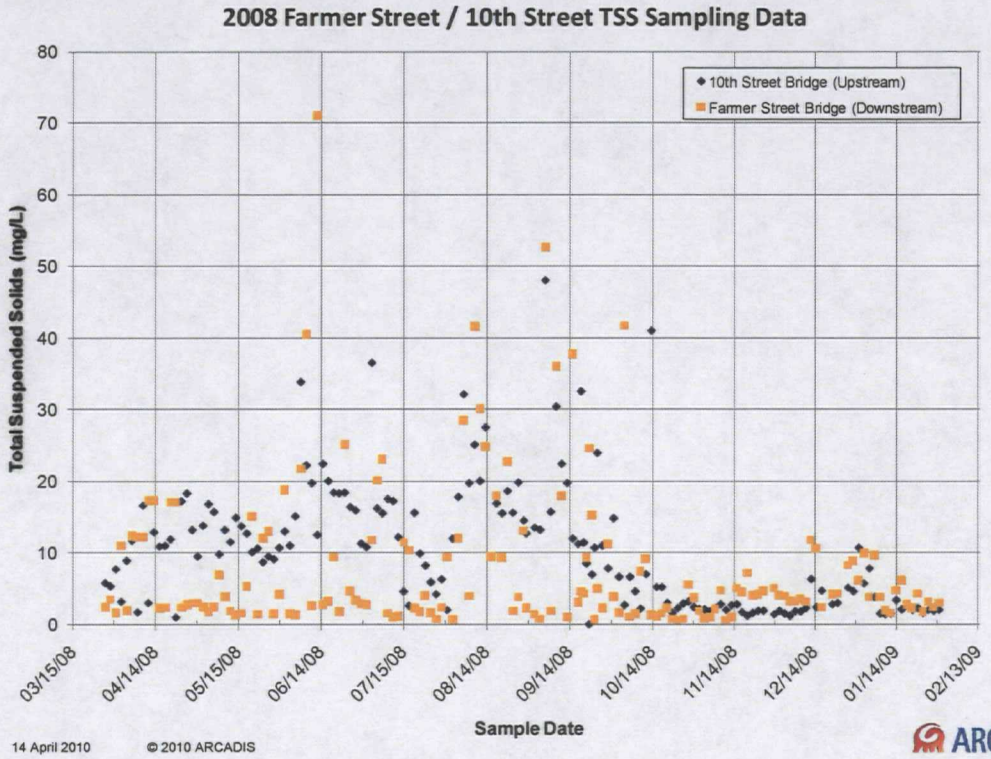
Surface Water Sampling TSS Data



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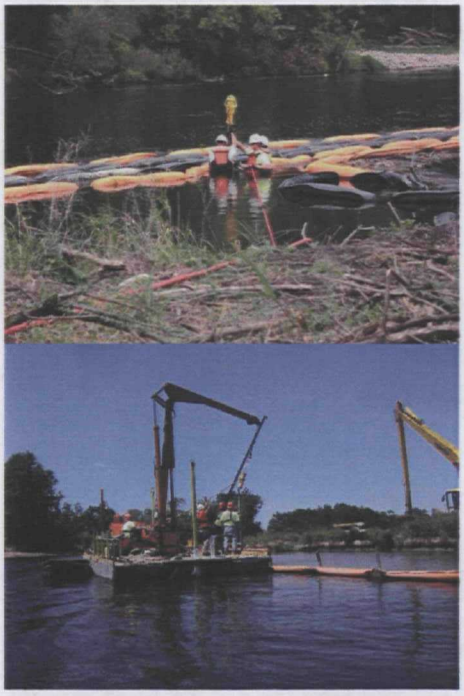
Turbidity Monitoring

- Real-time turbidity levels collected during all excavation activities at various times:
  - Prior to work start, at beginning of work, two hours after start, every hour during work, end of work day
- Three monitoring locations established for each work area – one upstream and two downstream
  - Action taken if turbidity value at furthest downstream location was two times higher than the upstream reading
- Potential mitigation measures:
  - Inspect control systems, inspect turbidity meter, slow/halt excavation, install additional controls



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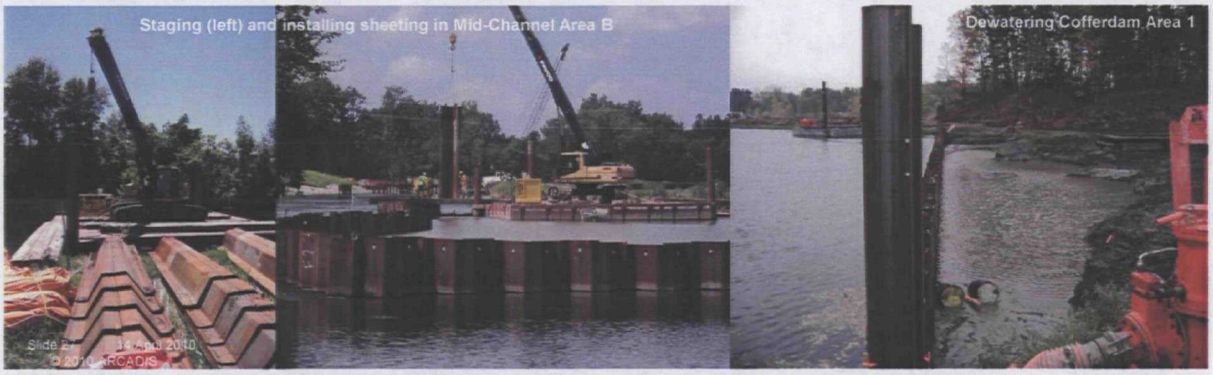
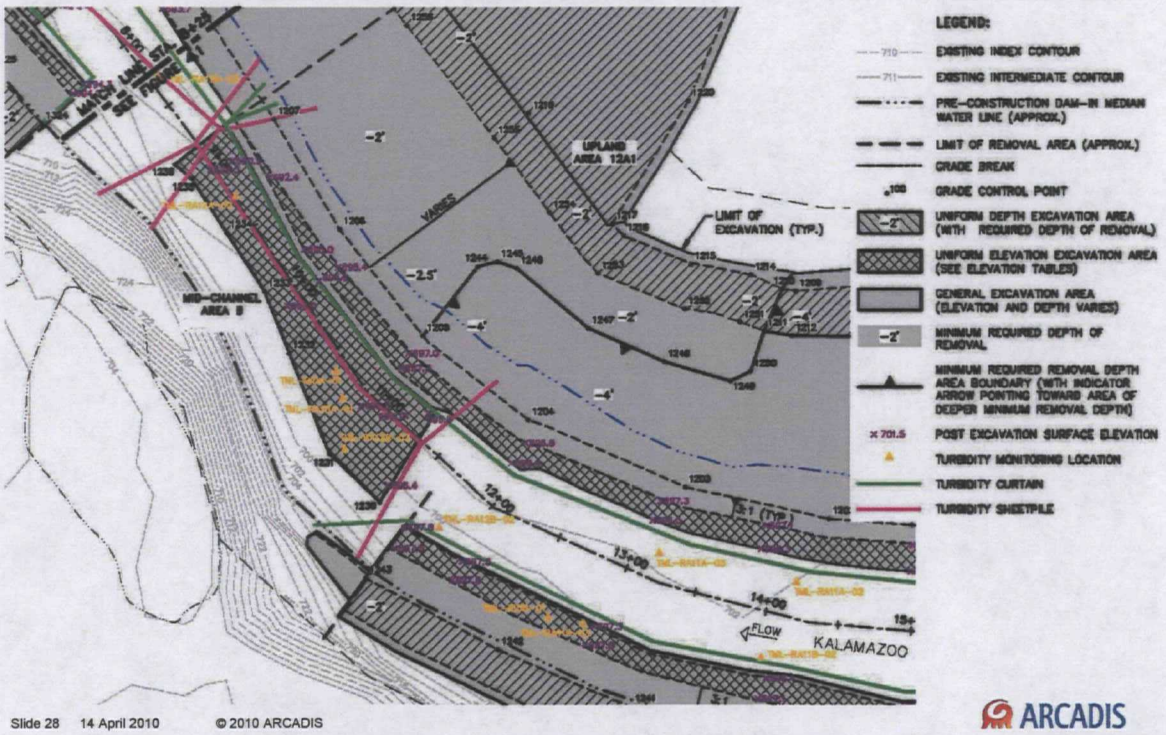
Turbidity Monitoring *(cont'd)*

Results:

- Visible plumes observed several times, but action level exceeded only in excavation of Mid-Channel Area B
  - Additional control equipment installed (deflector walls, more silt curtains) and work slowed – exceedances continued
  - Eventually completely enclosed the work area in steel sheeting
- Action level exceeded several times during dewatering of Cofferdam Area 1, so water was eventually pumped to the treatment system



Turbidity Monitoring *(cont'd)*



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Yearling Smallmouth Bass Monitoring in Otsego City Impoundment

- Objective: assess potential impacts associated with releases/erosion of sediments during construction
- Yearling smallmouth bass collected – yearlings have lower variance in PCB concentrations; therefore, more sensitive to changes than adults
- Fish collected in Otsego City Impoundment
- Three events carried out:
  - November 2006 – before work
  - November 2007 – after year 1
  - November 2008 – after year 2

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Yearling Smallmouth Bass Monitoring Results

- No statistically significant difference in average lipid-adjusted PCB concentration in 2006, 2007, 2008
- Data indicate removal activities did not significantly impact bioavailability of PCBs in downstream sampling area

Year	Sample Number (Composite/ Individuals)	Average Total PCB	Percent Lipids	Average Lipid-Adjusted PCB	Average Length	Average Weight
2006	7/35	1.5 mg/kg	1.3	116 mg PCB/kg lipid	14.3 cm	33.1 g
2007	5/10	3.0 mg/kg	2.6	115 mg PCB/kg lipid	15.4 cm	44.6 g
2008	7/49	2.3 mg/kg	2.0	117 mg PCB/kg lipid	13.9 cm	32.2 g

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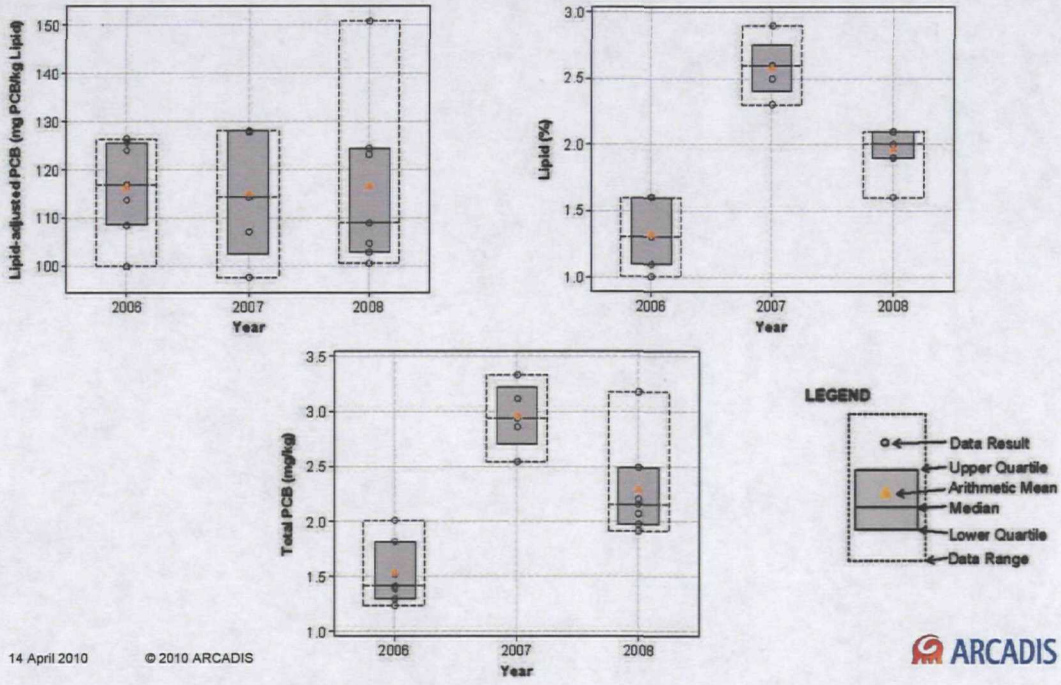
Yearling Smallmouth Bass Monitoring Results *(cont'd)*



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Post-Removal Sediment Sampling

- Objective: measure post-construction sediment PCB concentrations for use in risk assessments
- 80 surface sediment (0-2 inch depth) samples collected at 75 locations in 26 removal areas
  - January 2008: Removal Areas completed in 2007
  - March 2009: Removal Areas completed in 2008
- 41% of samples: PCBs not-detected
- 81% of samples: PCB concentration < 1 mg/kg
- Three highest values all from Removal Area 1

Statistic	Value
Range	ND – 48 mg/kg (at PCS-1-1)
Median	0.061 mg/kg
Average	1.7 mg/kg
Average excluding PCS-1-1	1.1 mg/kg

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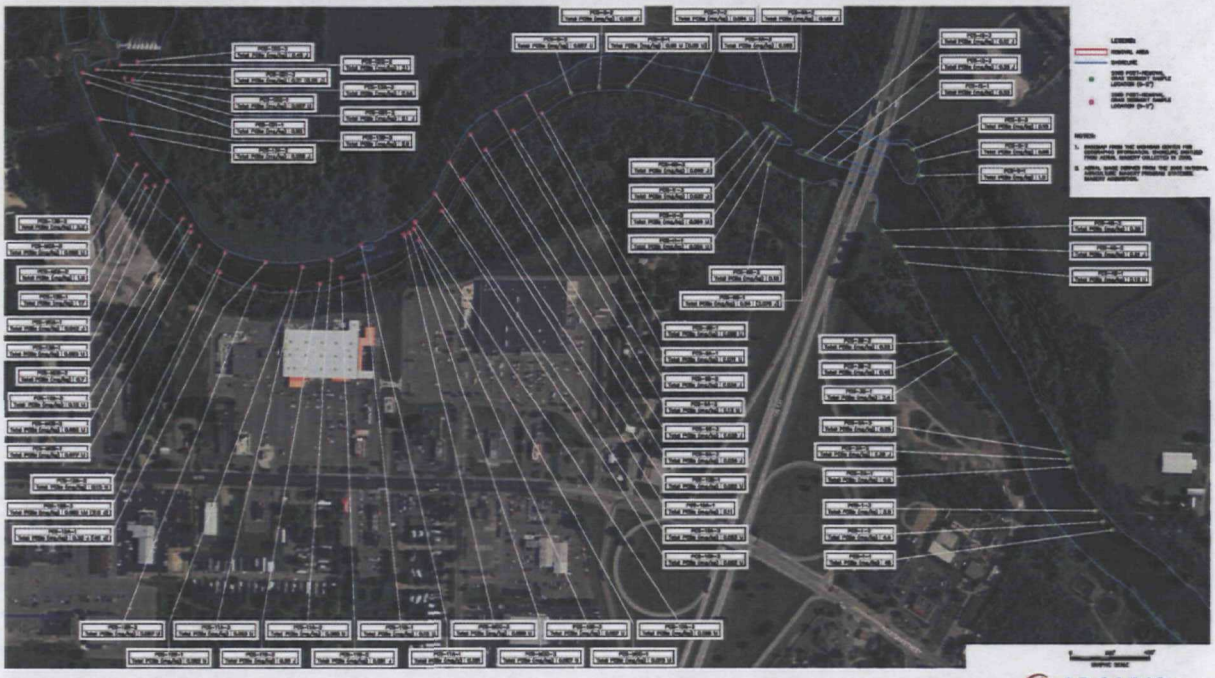
Post-Removal Surface Sediment Sampling
2008 and 2009 Results



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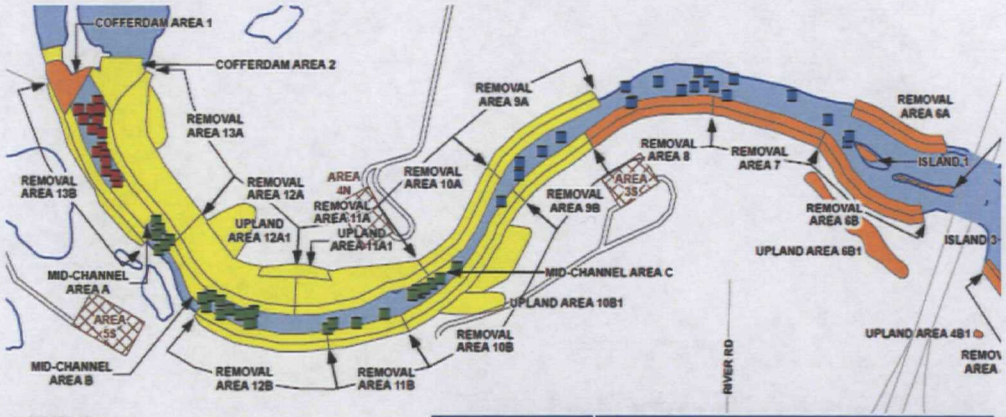
Samples from Mid-Channel Prism



LEGEND:

MID-CHANNEL SEDIMENT SAMPLE LOCATION:

- PLAINWELL DAM TO MID-CHANNEL A
- MID-CHANNEL A TO MID-CHANNEL C
- MID-CHANNEL C TO US-131

Mid-Channel Area	Average PCB Concentration (mg/kg)			
	Depth-Weighted	Surface	Sub-Surface	All Samples
Plainwell Dam to Mid-Channel A	0.12	0.15	0.17	0.16
Mid-Channel A to Mid Channel C	0.6	0.53	0.56	0.55
Mid-Channel C to US-131	0.080	0.073	0.11	0.089

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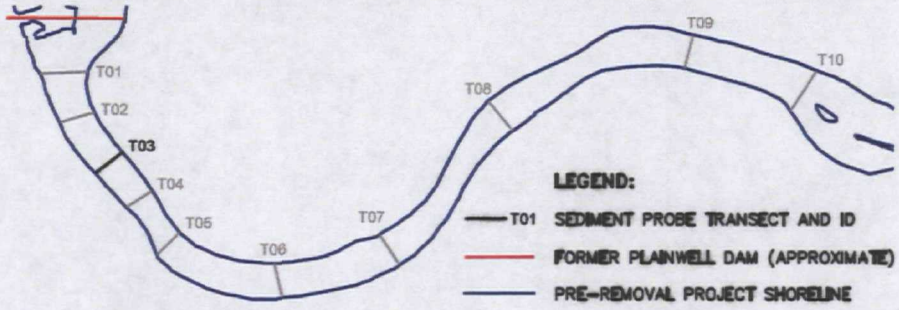
Bathymetric Monitoring

- Objective: assess movement of sediment following removal action as river channel establishes a new equilibrium in the re-energized system
- Monitor 10 transects established by USGS between US 131 Bridge and Plainwell Dam
- Monitor for two years or until 80% decrease in mid-channel prism
- Surveys to date:
  - December 2007, December 2008, July 2009, December 2009
- > 75% decrease in mid-channel prism volume observed in December 2009



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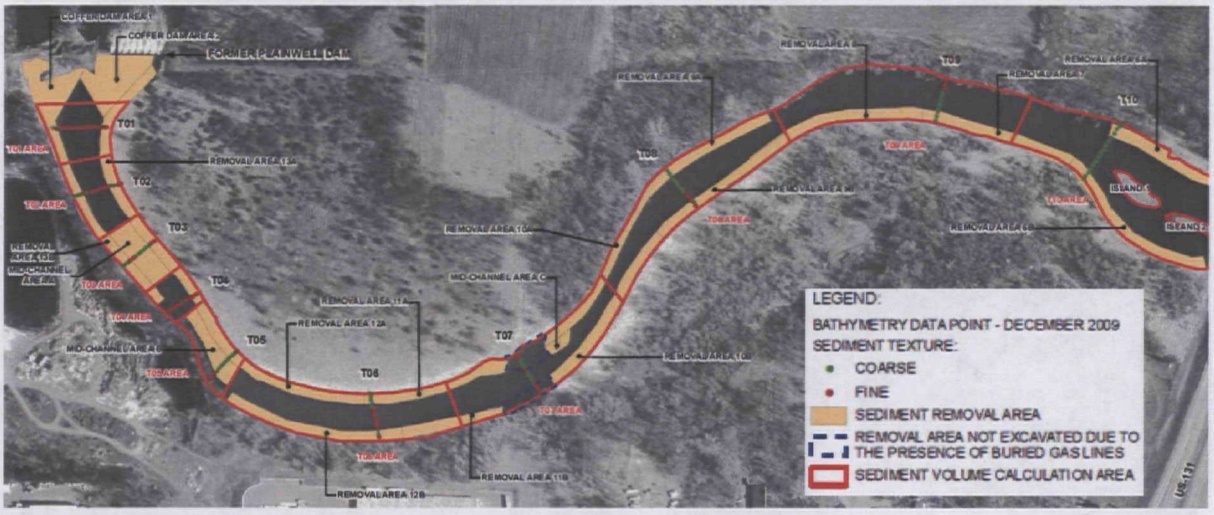
Survey Transects and Removal Areas



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Groundwater Monitoring

- Objectives: evaluate potential presence of PCBs in groundwater potential impacted by materials left in place
- Eight quarterly sampling events at network of 15 wells
- Four quarters of groundwater sampling completed to date
- All ARCADIS/TestAmerica sample results non-detect at average reporting limit of 0.05 µg/L
- All MDNRE/NEA sample results non-detect at average reporting limit of 0.025 µg/L
- Available data suggest migration of PCBs in groundwater not an issue

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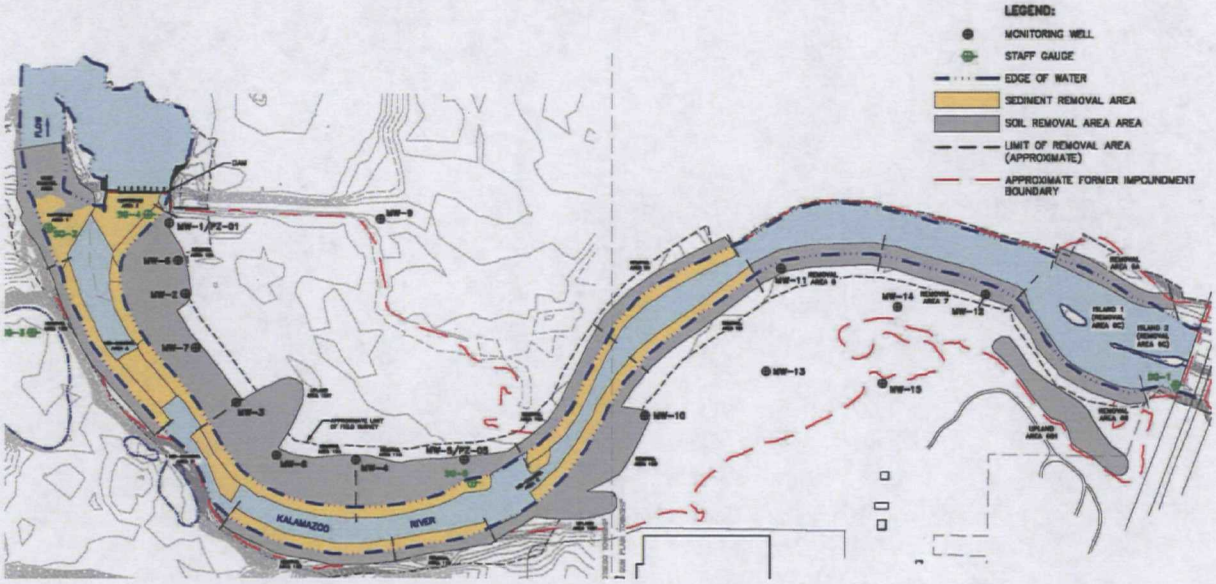
Groundwater Monitoring Locations



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Bank & Habitat Monitoring

- Annual monitoring of banks and restored habitat required for three years (per AOC, described in Design Report)
- Monitoring to include assessments of:
  - Bank conditions – determine need for maintenance and monitoring
  - Habitat/vegetation conditions – presence of exotic/invasive species
- Monitoring events in June and August 2009 included:
  - Visual inspections and evaluations of bank condition
  - Topographic survey of bank profiles at 11 benchmarked locations
  - Quantitative assessment of bank stability using the Bank Erosion Hazard Index (BEHI) developed by Rosgen (2006)
  - Quantitative evaluation of vegetation establishment (percent ground cover and percent weed cover) and survival

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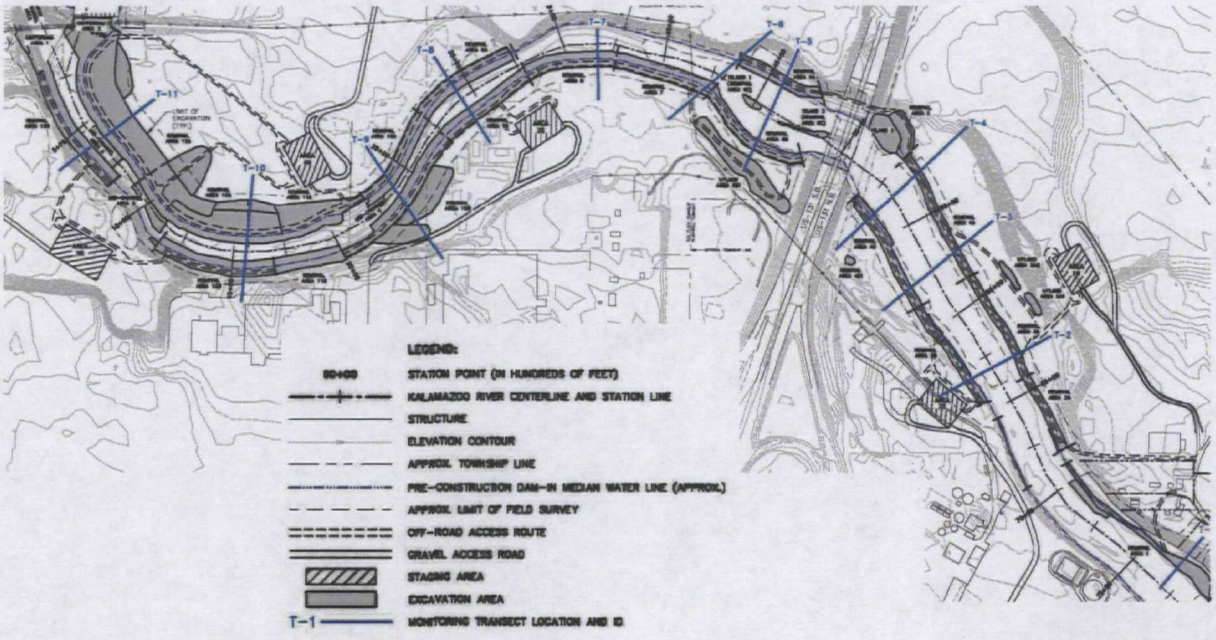
Bank Monitoring Transects



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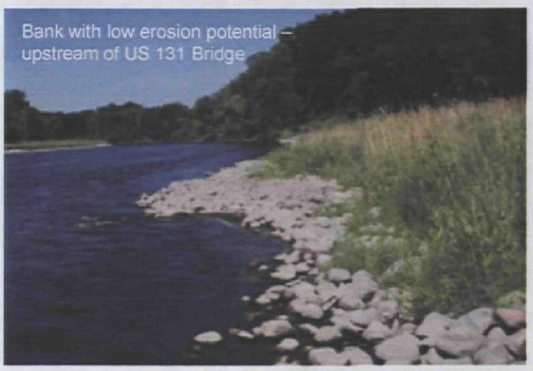
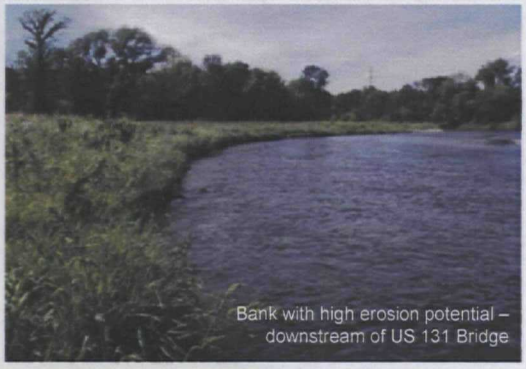
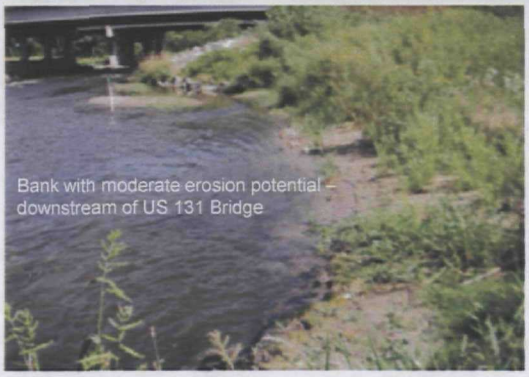
Bank Erosion Potential







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Bank & Habitat Monitoring: 2009 Results and Plans for 2010

2009 Results

- Erosion of banks in Removal Areas 8 and 9B observed – repaired in late October/early November
- Several patches of reed canary grass noted and treated with herbicide
- No other repair/maintenance or vegetation issues

2010 Plans

- Inspection planned for May/June 2010
  - Reclassify bank erosion potential
  - Survey at 11 established transects
- Collaborative inspection with USEPA/Trustees in July/August
  - Address issues identified, as appropriate

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Plainwell TCRA Effectiveness Considerations

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Effectiveness Considerations

- Short-Term Effectiveness
  - Source control
  - Resuspension controls
- Long-Term Effectiveness
  - Erodable soil and sediment PCB inventory reduction
  - Soil and sediment PCB exposure reduction
  - Fish tissue PCB reductions
- Long-Term Recovery

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Short-Term Effectiveness

- **Source Control**
  - Approximately 10 kg/yr PCB loading eliminated via bank stabilization (32% of the measured former impoundments bank erosion load)
- **Resuspension Controls**
  - No discernable increase in PCB or solids load carried by the river during construction, as indicated by upstream and downstream surface water monitoring
  - No discernable change in bioavailable PCB concentrations in the Otsego City Impoundment over the course of removal activities
  - Gradual loss of mid-channel prism following water level drawdown and water control structure removal

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Long-Term Effectiveness

- **Source Control**
  - 4,950 pounds (2250 kg) of PCB removed from potentially erodable inventory of bank soils, near-shore floodplain soils, toe-of-bank sediments, and mid-channel "hot spots"
  - 104,300 cy of PCB-containing material removed from potentially erodable inventory
  - Note: the PCB mass in the remaining mid-channel prism is approximately 6.8 kg – equivalent to ~2/3 of 1 year of bank erosion
- **Exposure Reduction**
  - Soil PCB levels in removal areas addressed by removal and backfill with cleaner soil
  - Post-construction removal area sediment PCBs average 1.1 ppm*, median 0.061 ppm
  - Samples from three remaining mid-channel prism areas averaged 0.12, 0.60, 0.08 ppm

*Excluding 48 ppm sample, which was from an adjacent area added in the field after removal underway.
Average of post-removal sediment PCB samples is 1.7 ppm with that sample included.

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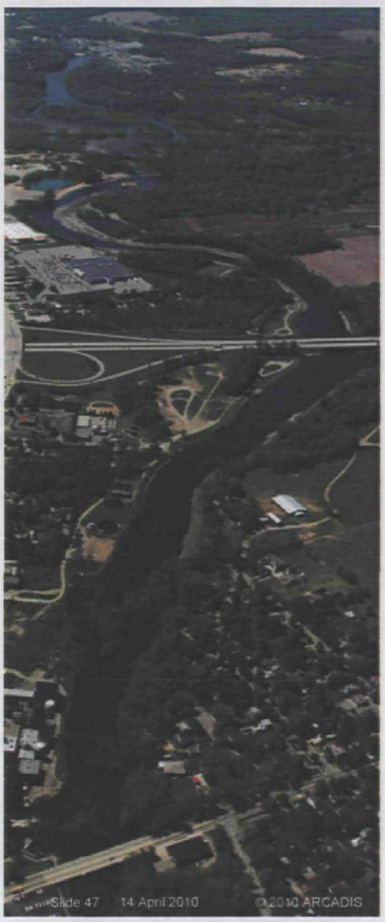

Long-Term Recovery

- Reductions in PCB exposure and fish tissue PCB concentrations will take time
- Source control is the priority to enable recovery
- Cleanup efforts in source areas are expected to reduce exposures over time and lead to further long-term declines in fish PCB levels
- Continuation of long-term monitoring will document trends in fish tissue
- Full recovery and removal of the most restrictive fish consumption advisories will require patience and depend on declines in upstream, urban area, and regional atmospheric sources

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